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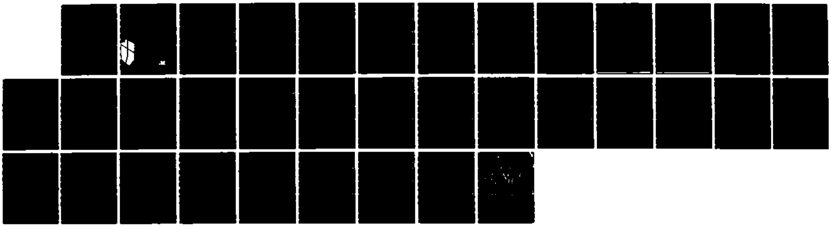

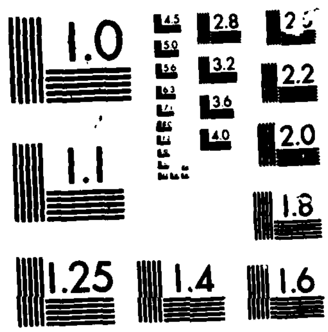

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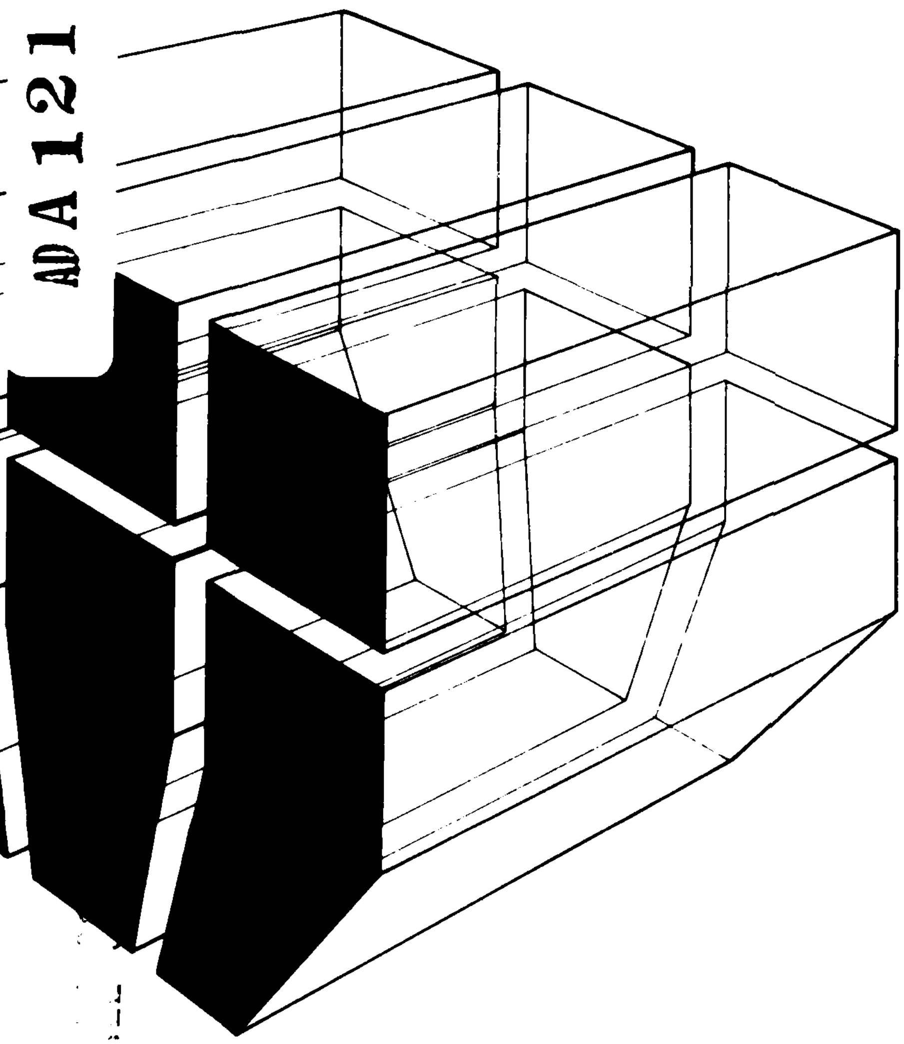
TECHNICAL REPORT P-131
September 1982
Engineer Modeling Study

ENGINEER MODELING STUDY VOLUME II: USERS MANUAL

by
Gerald Brown
Hugh Henry



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This is the second volume of a three-volume report that documents the capabilities and use of the Engineer Module developed by the U.S. Army Construction Engineering Research Laboratory (CERL). This module is designed to operate as part of CORDIVEM, the corps- and division-level component of the Army Model Improvement Program (AMIP). The Engineer Module represents the contribution of the combat engineer to the combined arms team during computer-simulated battles by altering terrain characteristics within the simulation's data base.

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This volume lists the program input requirements for the Engineer Module and describes how to interpret program results. Error messages and a bibliography are included.

FOREWORD

This study was performed for the Directorate for Combat Developments (DCD), U.S. Army Engineer School (USAES), under Project 4A762731AT41, "Military Facilities Engineering Technology"; Task D, "Combat Engineering Strategy"; Work Unit 048, "Engineering Modeling Study." The USAES/DCD Technical Monitor was CPT Clifford Clausen.

The study was conducted by the Facility Systems (FS) Division of the U.S. Army Construction Engineering Research Laboratory (CERL). CERL personnel directly involved in the study were Dr. Gordon Bagby, Mr. Gerald Brown, Mr. Carlton Mills, Mr. Theodore Tourlentes, and 1LT Hugh Henry. Appreciation also is expressed to Professor John Boyd of Knox College, Galesburg, IL, for his help with this work. Mr. Edward Lotz is Chief of CERL-FS.

COL Louis J. Circeo is Commander and Director of CERL, and Dr. L. R. Shaffer is Technical Director.

A

CONTENTS

ENGINEER MODELING STUDY VOLUME II: USERS MANUAL

1 INTRODUCTION

Background

Existing Army war games are good at representing unit offensive and defensive movements, but weak in measuring the contribution of combat engineer activities to the combined arms team. The value and effectiveness of engineer fortifications and barriers are well known, but current models ignore the combat engineers completely, confining engineer representation to obstacle effects, or estimating their efforts by extrapolation using a post-processor.[1]

In 1979, the U.S. Army Engineer School (USAES), representing the Training and Doctrine Command (TRADOC), asked the U.S. Army Construction Engineering Research Laboratory (CERL) to correct this deficiency. The Engineer Module, developed under CERL's Engineer Modeling Study (EMS), was the result. This volume is the second in a three-volume report which documents the capabilities and use of CERL's Engineer Module. The other volumes are:

Volume I: Executive Summary

Volume III: CORDIVEM/Engineer Module Interface Manual

This volume provides the information necessary to prepare data for input to the Engineer Module, run the module in the stand-alone mode (without CORDIVEM interface), and understand the module's output.

The Engineer Module is data-driven. This allows the user to make different computer runs by changing the data base, rather than by changing the program code. This makes it easy for the user to simulate new engineer systems, new engineer tactics, and different command and control relationships. Since there will always be more requests for engineer resources than there are engineer resources available, the user must input automatic prioritization data to allocate resources among competing requests. The allocation of resources then will vary, depending on the user's situation and the prioritization data.

Because the Engineer Module is data-driven, the user must input a considerable amount of data before the model will run. Once the data are loaded into computer files, a text editor is used to modify the data base for subsequent runs.

Objective

The overall objectives of this study were:

1. To model the contribution of friendly and enemy engineers to the effectiveness of the combined arms team.

2. To represent, with accuracy and consistency, the effectiveness of the combat engineer effort throughout the Army Model Improvement Program (AMIP) model hierarchy.

[1]*Engineer Family of Systems Study (E-FOSS)* (U.S. Army Engineer School, 1979); *The Value of Field Fortification in Modern Warfare* (Historical Evaluation and Research Organization, 1979); and *Historical Evaluation of Barrier Effectiveness* (Historical Evaluation and Research Organization, 1974).

3. To develop a system that the USAES and other agencies can use to (a) review modeling data so new equipment or doctrine can be incorporated easily, and (b) support the evaluation of hypothetical equipment or doctrine.

The objective of this volume is to (1) explain how to use CERL's Engineer Module, (2) help the user prepare program input, and (3) help the user interpret program results.

2 DATABASE–AN OVERVIEW

Eight major sections comprise the Engineer Module input:

1. Engineer Systems (ESY)

2. Techniques (TEC)

3. Tasks (TSK)

4. Single Job Orders (SJO)

5. Multiple Job Orders (MJO)

6. Standard Requirements Code (SRC)

7. Engineer Units (EUT)

8. Tactical Units (TUT).

Each of these sections is a separate computer file. Each file is identified by an input section acronym and up to a three-character prefix, e.g., ⟨xxx⟩ SJO. Throughout this volume, the symbols "⟨" and "⟩" will bracket names for user-defined input. That is, ⟨xxx⟩ SJO is a notation for a six-character file name. The first three characters are defined by the user, but the system requires that the last three characters be SJO. For instance, if the user wants two test files, the files may be named TØ1SJO and TØ2SJO. User names like TEST1 and TEST2 violate the ⟨xxx⟩ SJO convention, and any attempts to use them will cause problems. (When using the VAX 11/780, file names should be followed by a period and the letters DAT. For example, the tasks file could be named D86TSK.DAT.) The Engineer Module's data structure is shown in Figure 1.

An interactive editor or a punch card system may be used to create these files. If the user is unfamiliar with such systems, one of the following manuals may be consulted.

For Boeing Cyber users:

> *MAINSTREAM-EKS Interactive Timesharing (KIT) Users Manual* (Boeing Computer Services Inc., 1977)

For DEC/VAX 11/780 users:

> *VAX/VMS Users Manual, Volume 3A* (Software Distribution Center, Digital Equipment Corporation, 1980).

The following paragraphs briefly describe each of the major input sections.

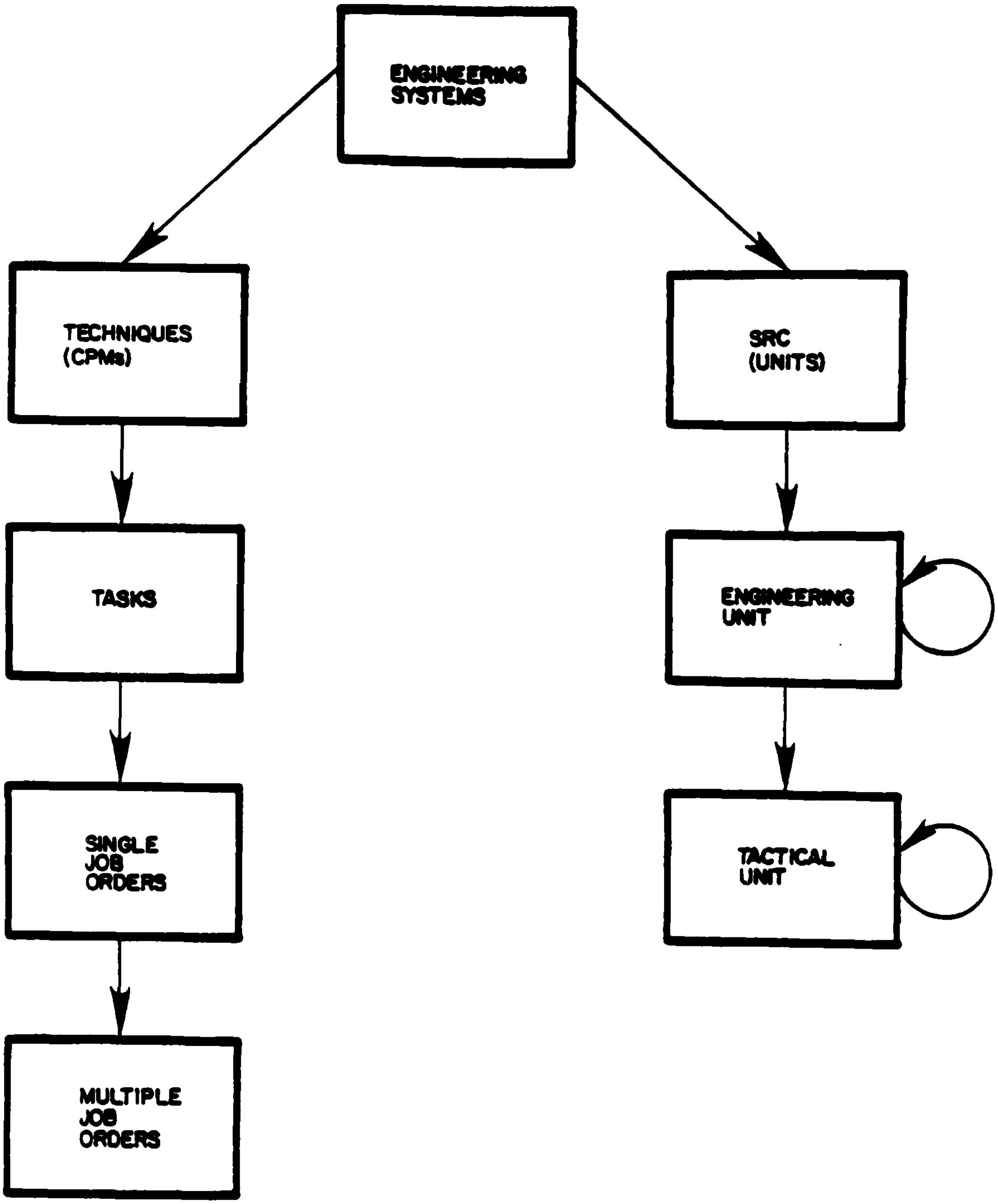

Figure 1. Engineer Module data structure hierarchy.

Engineer Systems

An engineer system is the basic element modeled by the Engineer Module, i.e., a CEV, D-7, or SQUAD. At present, the only attribute of an engineer system is velocity, since it must travel from its unit to the work site. Data on engineer systems and their velocity may be obtained from the Engineer Family of Systems Study (E-FOSS) report or threat data (see Appendix A).

Engineer Systems: Input Instructions

1. Engineer System Name (10-character maximum)

2. Engineer System Move Rate (km/hr)

NOTE: REPEAT 1 AND 2 FOR EACH SYSTEM.

Engineer Systems: Sample Data

SQUAD	*(engineer system name)*
50	*(velocity in km/hr)*
D-7	*(engineer system name)*
35	*(velocity in km/hr)*
ACE	*(engineer system name)*
45	*(velocity in km/hr)*
CEV	*(engineer system name)*
45	*(velocity in km/hr)*
2.5LOADER	*(engineer system name)*
35	*(velocity in km/hr)*
AVLB	*(engineer system name)*
45	*(velocity in km/hr)*
50M.BRIDGE	*(engineer system name)*
50	*(velocity in km/hr)*
SLUFAE	*(engineer system name)*
45	*(velocity in km/hr)*
GEMSS	*(engineer system name)*
45	*(velocity in km/hr)*

Techniques

A graph or network of activities is used to represent engineer techniques such as CONSTRUCT 5 DEFILADES -- CEV. The input consists of a description of the graph (node number, successor and predecessor nodes) and the resources required. An example of an engineer network which might be modeled is shown in Figure 2. Data on combat engineer techniques, resources, and time estimates may be obtained from appropriate Army Training and Evaluation Program (ARTEP) publications and Army Field Manuals (see Appendix A).

Technique: Input Instructions

1. Technique Name (50-character maximum)

2. Number of Resources

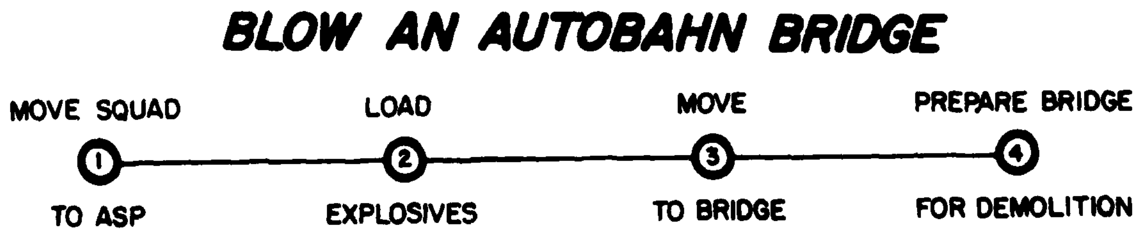

Figure 2. Example engineer network.

3. Resource Identification Number and Minimum Time to Completion (minutes)

4. Resource Name (must be an engineering system)

NOTE: REPEAT 3 AND 4 FOR EACH RESOURCE.

5. Number of nodes

6. A. Node Type - M.WS/M.ASP/L/W - Move to Work Site, Move to Ammunition Supply Point (ASP), Load, Work

   B. Node Number

   C. Time (minutes) or Move Rate (km/hr)

   D. Number of Predecessors

7. Number of Active Resources (list of resource identification numbers)

8. Number of Released Resources (list of resource identification numbers)

9. Number of Successor Nodes (list of successor nodes)

NOTE: REPEAT 6 THROUGH 9 FOR EACH NODE.

WHEN NODE TYPE (ITEM 6A) IS M.WS OR M.ASP, ITEM 6C DESCRIBES MOVE RATE.

WHEN NODE TYPE IS L OR W, ITEM 6C DESCRIBES MINUTES TO *NODE* COMPLETION.

Technique: Sample Input Data

BLOW AN AUTOBAHN BRIDGE	*(technique name)*
1	*(number of resources)*
1 210	*(resource identification number, number of minutes to technique completion)*
SQUAD	*(resource name)*
4	*(number of nodes)*
M.ASP 1 50 0	*(node type, node number, move rate in km/hr, number of predecessor nodes)*
1 1	*(number of active resources, resource identification number[s])*
0	*(number of released resources)*
1 2	*(number of successor nodes, successor node number[s])*
L 2 30 1	*(node type, node number, number of minutes to node completion, number of predecessors)*
1 1	*(number of active resources, resource identification number[s])*
0	*(number of released resources)*
1 3	*(number of successor nodes, successor node number[s])*
M. WS 3 50 1	*(node type, node number, move rate in km/hr, number of predecessors)*
1 1	*(number of active resources, resource identification number[s])*
0	*(number of released resources)*
1 4	*(number of successor nodes, successor node number[s])*
W 4 180 1	*(node type, node number, minutes to node completion, number of predecessors)*
1 1	*(number of active resources, resource identification number[s])*
1 1	*(number of released resources, resource identification number[s])*
0	*(number of successor nodes)*

CONSTRUCT 5 DEFILADES - TANK OR APC - ACE	*(technique name)*
1	*(number of resources)*
1 135	*(resource identification number, number of minutes to technique)*
ACE	*(resource name)*
2	*(number of nodes)*
M.WS 1 50 0	*(node type, node number, move rate in km/hr, number of predecessors)*
1 1	*(number of active resources, resource identification number[s])*
0	*(number of released resources)*
1 2	*(number of successor nodes, successor node identification number[s])*
W 2 135 1	*(node type, node number, number of minutes to node completion or number of predecessors)*
1 1	*(number of active resources, resource identification number[s])*
1 1	*(number of released resources, resource identification number[s])*
0	*(number of successor nodes)*

Tasks

Techniques which have similar results are grouped into tasks. For example, the task CRATER ROAD might use the techniques M180 or SHAPED/CRATER CHARGE. The user must define the default technique selection and battlefield importance rating of single task orders. For each single task order, the user selects a list of techniques that could fulfill the single task order, grades each technique according to how appropriate or desirable it is (Table 1), and rates the order's battlefield importance for different situations (Table 2).

The user can vary the grading and rating of techniques for a task depending on the situation. For example, when there is no enemy threat, the user may wish to use D-7s to dig defilades. When there is an enemy threat, he may choose the ACE since it provides armor protection for the operator. Depending on the data available and other constraints, the situation could be defined by one of the two methods shown in Figure 3. Other

Table 1
The Task/Technique Grading Scale

GRADE	MEANING
A	Preferred technique and preferred use of resources
B	Same as A, but somewhat less effective or preferable
C	Effective/nonstandard choices, but not the optimum
D	Ineffective technique or dangerous given the situation/location
E	Same as D, but less desirable

Each engineering task and technique must be graded on its effectiveness. The model will always attempt to select the highest graded technique consistent with what resources are available and when the job must be completed.

The grade impacts the scheduling algorithm and the generation of unit movement orders. Current plans are to continue searching up the chain of command until resources for a Grade A or B technique are found. Otherwise, a Grade C, D, or E technique will be selected. Grade D or E tasks/techniques must always use the company's internal resources. Thus, no unit move orders will be issued from battalion to the company to perform such low-grade task/techniques; these jobs will be queued until resources become available.

It will not always be necessary to provide an entry for each grade: some jobs may have only A or B alternatives.

Table 2
Estimated Consequence to Mission Success of Not Receiving Engineer Support (Priority)

Priority Rating Scale	Severity Description	How Commanders Will Perceive the Consequences of Not Receiving Engineer Support
1 2 3	None (lowest priority)	Unit ability to accomplish the mission is not degraded. An alternate "non-engineer" technique of equal effectiveness can be employed. For example, the commander perceives unit tanks can be concealed in local terrain. Lack of engineer support to dig tanks in should not prevent unit from defending the area.
4 5 6	Moderate	Unit ability to accomplish the mission is mo...rately degraded. Commander diverts unit assets from their primary mission to accomplish engineer tasks for which they are not trained or equipped. For example, lack of engineer support requires infantry soldiers to cut trees at a roadblock instead of improving TOW positions servicing the obstacle. As a result, the TOWs may service fewer targets before being discovered and suppressed.
7 8	Significant	Unit ability to accomplish the mission is significantly degraded. Commander is forced to deploy a material system in a dangerous or ineffective manner. For example, lack of engineer support at a forward arming and refueling point reduces the servicing capacity of the point and decreases its survivability.
9	Serious (highest priority)	Unit ability to accomplish mission is affected to the extent the mission may be aborted. For example, without engineer support the commander determines time is not adequate to develop a strongpoint defense which was determined the only defense tactic possible against threat forces in that area.

factors that could help define situations are offensive or defensive operations, dirty-battlefield conditions, day or night, etc. The inclusion of many factors to define the situation will expand data input requirements, the size of the data base, and the simulation run time.

This is a default mechanism only. Orders can be given with explicit priority. However, a default mechanism is needed to reduce the workload on the engineer gamer.

The user must resolve four separate issues:

1. Define *situations.*

2. Rank alternative *techniques* for each situation.

3. Identify *task groupings* and assign them priorities for each situation.

4. Identify (on an exception basis) how threat engineer tactics differ from those used by U.S. engineer units.

The rankings so obtained will be used by the Engineer Module to allocate engineer resources when more than one task has been assigned to a particular unit.

Task: Input Instructions

1. Task Name (30-character maximum)

EXAMPLE A

DISTANCE FROM SUPPORTED MANEUVER UNIT TO WORKSITE

	≤ 7 Km	> 7 Km
CONTACT WITH ENEMY	1	2
NO CONTACT WITH ENEMY	3	4

EXAMPLE B

TERRAIN TYPE	SITUATION
URBANIZED	1
FORESTED	2
MOUNTAINOUS	3
OPEN	4

Figure 3. Example situation definition.

2. Number of Situation Ranges

3. First Situation   Last Situation (range for techniques)

4. Number of Techniques for Range

5. Technique Name

6. Grade (Valid A, B, C, D, or E; see Table 1)

NOTE: REPEAT 5 AND 6 FOR EACH TECHNIQUE. REPEAT 3, 4, 5, AND 6 FOR EACH RANGE.

7. Two-Character Code for Task

8. Number of Situation Ranges (for priority class assignment)

9. First Situation   Last Situation   Priority (See Table 2 for priority codes)

NOTE: REPEAT 9 FOR EACH SITUATION RANGE.

Task: Sample Input Data

CONSTRUCT 5 HULL DEFILADES *(task name)*
1 *(number of situation ranges)*
1 1 *(first situation, last situation)*
3 *(number of techniques for range)*
CONSTRUCT 5 DEFILADES TANK OR APC ACE *(technique name)*
A *(grade)*
CONSTRUCT 5 DEFILADES TANK OR APC CEV *(technique name)*
A *(grade)*
CONSTRUCT 5 DEFILADES TANK OR APC D-7 *(technique name)*
A *(grade)*
SA *(two-character code for task)*
1 *(number of situation ranges)*
1 1 5 *(first situation, last situation, priority)*

Single Job Orders

Tasks which have similar results are grouped to form single job orders. For example, the order BLOCK ROAD might use the tasks CRATER ROAD or CONSTRUCT ABATIS. The data input structure for single job orders is the same as it is for tasks. The user must grade and assign a priority to each task.

Single Job Order: Input Instructions

1. Single Job Order Name (30-character maximum)

2. Number of Situation Ranges

3. First Situation Last Situation (range for tasks)

4. Number of Tasks for Range

5. Task Name

6. Grade (Valid A, B, C, D, or E; see Table 1)

NOTE: REPEAT 5 AND 6 FOR EACH TASK. REPEAT 3, 4, 5, AND 6 FOR EACH RANGE.

7. Two-Character Code for Single Job Order (optional)

8. Number of Situation Ranges (for priority class assignment)

9. First Situation Last Situation Priority (see Table 2 for priority codes)

NOTE: REPEAT 9 FOR EACH SITUATION RANGE.

Single Job Order: Sample Input Data

In this sample, input data for four situations were defined as shown in Example B, Figure 3.

BLOCK ROAD *(single job order name)*
3 *(number of situation ranges)*
1 1 *(first situation, last situation)*

2 *(number of tasks for range)*
RUBBLE STREET *(task name)*
A *(grade)*
CRATER ROAD *(task name)*
A *(grade)*
2 3 *(first situation, last situation)*
3 *(number of tasks for range)*
CONSTRUCT ABATIS *(task name)*
B *(grade)*
CRATER ROAD *(task name)*
A *(grade)*
BUILD LOG CRIB *(task name)*
B *(grade)*
4 4 *(first situation, last situation)*
2 *(number of tasks for range)*
POINT MINEFIELD *(task name)*
A *(grade)*
CRATER ROAD *(task name)*
A *(grade)*
CB *(two-character code)*
2 *(number of situation ranges for priority class assignment)*
1 3 9 *(first situation, last situation, priority)*
4 4 6 *(first situation, last situation, priority)*

Multiple Job Orders

The user may wish to group single job orders by situation to produce a desired result. For example, the order CONSTRUCT STRONGPOINT might consist of the single job orders CRATER ROAD, DIG DEFILADES, CONSTRUCT MINEFIELDS, and CONSTRUCT ANTI-TANK DITCHES. The order, quantity, and priority of the single job orders may vary depending on the situation, and must be specified by the user.

Multiple Job Order: Input Instructions

1. Multiple Job Order Name (30-character maximum)

2. Number of Situation Ranges

3. First Situation Last Situation (range for single job orders)

4. Number of Single Job Orders for Range

5. Single Job Order Name

6. Priority (see Table 2 for priority codes)

NOTE: REPEAT 5 AND 6 FOR EACH SINGLE JOB ORDER. REPEAT 3, 4, 5, AND 6 FOR EACH RANGE.

Multiple Data Job Order: Sample Data

BATTLE POSITION TYPE 1 *(multiple job order name)*
1 *(number of situation ranges)*
1 1 *(first situation, last situation)*
3 *(number of single job orders for range)*

CONSTRUCT 5 HULL DEFILADES *(single job order name)*
5 *(priority)*
CONSTRUCT 5 HULL DEFILADES *(single job order name)*
5 *(priority)*
CONSTRUCT 500 M. ANTITANK DITCH *(single job order name)*
5 *(priority)*

Standard Requirements Code

The standard requirements code is similar to the Tables of Organization and Equipment (TOE) in that the type and quantity of basic engineer systems are input for each type of engineer unit. The user must specify standard requirements codes for both friendly and enemy forces.

Standard Requirements Code: Input Instructions

1. Standard Requirements Code Name (30-character maximum)

2. Color (Blue or Red)

3. Number of Systems

4. Engineer System Name

5. Quantity

NOTE: REPEAT 4 AND 5 FOR EACH SYSTEM IN THE STANDARD REQUIREMENTS CODE.

Standard Requirements Code: Sample Input Data

ENG.PLT.DIV	*(standard requirements code name)*
BLUE	*(color)*
3	*(number of systems)*
SQUAD	*(system name)*
3	*(quantity)*
SQUAD	*(system name)*
3	*(quantity)*
CEV	*(system name)*
1	*(quantity)*
ACE	*(system name)*
2	*(quantity)*
ENG.CO.POOL	*(standard requirements code name)*
BLUE	*(color)*
4	*(number of systems)*
2.5LOADER	*(system name)*
1	*(quantity)*
GEMSS	*(system name)*
1	*(quantity)*
AVLB	*(system name)*
6	*(quantity)*
SLUFAE	*(system name)*
2	*(quantity)*
NONE	*(standard requirements code name)*
BLUE	*(color)*
0	*(number of systems)*

NOTE: THE USER MUST INCLUDE A STANDARD REQUIREMENTS CODE NAMED NONE WHICH HAS Ø SYSTEMS. THIS IS THE STANDARD REQUIREMENTS CODE OF THE HIGHEST LEVEL HEADQUARTERS UNIT.

Engineer Units

An engineer unit's assets are defined by its standard requirements code. Several engineer units may have the same code. The engineer unit input requires the user to establish command and control relationships (pointers to the parent engineer unit and the supported tactical unit) as well as X and Y coordinates on the battlefield for both U.S. and threat forces. These coordinates express distance in kilometers from a user-defined point. Although many different standard requirements codes may be used in a simulation run, Red and Blue engineer forces are each limited to two levels of command and control. For example, the user may define engineer platoon/engineer company or engineer battalion/engineer brigade relationships, but not an engineer platoon/engineer company/engineer battalion relationship.

Engineer: Unit Input Instructions

1. Engineer Unit Name (20-character maximum)

2. Standard Requirements Code Name

3. Color (Blue or Red)

4. Parent Engineer Unit Pointer

5. Supported Tactical Unit Pointer

6. X-Location Y-Location (kilometers)

NOTE: REPEAT 1 THROUGH 6 FOR EACH ENGINEER UNIT.

Engineer Unit: Sample Input Data

```
1ST.PLT.A.CO       (engineer unit name)
ENG.PLT.DIV        (standard requirements code name)
BLUE               (color)
5 1                (parent unit, supported tactical unit)
32.ØØ3 33.637      (X coordinate, Y coordinate)
2ND.PLT.A.CO       (engineer unit name)
ENG.PLT.DIV        (standard requirements code name)
BLUE               (color)
5 2                (parent unit, supported tactical unit)
29.541 31.Ø5Ø      (X coordinate, Y coordinate)
3RD.PLT.A.CO       (engineer unit name)
ENG.PLT.DIV        (standard requirements code name)
BLUE               (color)
5 3                (parent unit, supported tactical unit)
3Ø.551 27.624      (X coordinate, Y coordinate)
A.CO.POOL          (engineer unit name)
ENG.CO.DIV.(+).POOL  (standard requirements code name)
BLUE               (color)
5 Ø                (parent unit, supported tactical unit)
26.Ø69 31.888      (X coordinate, Y coordinate)
```

A.CO.HQ	*(engineer unit name)*
NONE	*(standard requirements code name)*
BLUE	*(color)*
0 0	*(parent unit, supported tactical unit)*
26.069 31.888	*(X coordinate, Y coordinate)*

Tactical Units

The user must enter the name of the tactical unit and parent and supporting engineer unit pointers to establish a command and control relationship for allocating engineer resources. The data field should contain inputs for both friendly and enemy forces.

Tactical Unit: Input Instructions

1. Tactical Unit Name (20-character maximum)

2. Color (Blue or Red)

3. Parent Tactical Unit Pointer

4. Supporting Engineer Unit Pointer

NOTE: REPEAT 1 THROUGH 4 FOR EACH TACTICAL UNIT.

Tactical Unit: Sample Input Data

5TH.BN.1ST.BDE	*(tactical unit name)*
BLUE	*(color)*
4 1	*(parent unit, supporting engineer unit)*
6TH.BN.1ST.BDE	*(tactical unit name)*
BLUE	*(color)*
4 2	*(parent unit, supporting engineer unit)*
7TH.BN.1ST.BDE	*(tactical unit name)*
BLUE	*(color)*
4 3	*(parent unit, supporting engineer unit)*
1ST.BDE	*(tactical unit name)*
BLUE	*(color)*
0 4	*(parent unit, supporting engineer unit)*

Order Stream

After all eight major data sections have been defined and entered into corresponding data files, the user must create a job file, (xxx) JOBS, to exercise the Engineer Module. Each record in the file will be an individual job, with a name, start and finish time, X and Y location, and a requestor and situation code.

Order Stream: Input Instructions

1. External Event (RCRD on Cyber, RECEIVE.ORDER on VAX)

2. Start Time (day hour minute)

3. Order Name (single job order or multiple job order)

4. Five-Character Order Abbreviation

5. X Location Y Location

6. Late Finish/Deadline Time (day hour minute)

7. Requestor (tactical unit pointer)

8. Situation

9. Optional override of default priority (see Table 2 for priority codes)

10. *

NOTE: REPEAT 1 THROUGH 10 FOR EACH ORDER.

Order Stream: Sample Input Data

External Event	*(RCRD on Cyber,* RECEIVE.ORDER *on VAX)*
Ø Ø Ø	*(start time day, hour, minute)*
CRATER ROAD	*(order name)*
CRTRD	*(order abbreviation)*
132 136.8	*(X location, Y location)*
1 Ø Ø	*(late finish time day, hour, minute)*
1	*(requestor)*
1	*(situation)*
*	
External Event	*(RCRD on Cyber,* RECEIVE.ORDER *on VAX)*
Ø Ø Ø	*(start time day, hour minute)*
CRATER ROAD	*(order name)*
CRTRD	*(order abbreviation)*
133.8 1Ø6.2	*(X location, Y location)*
1 Ø Ø	*(late finish time day, hour, minute)*
1	*(requestor)*
1	*(situation)*
*	

PROCFIL/PSEUPROC.OLD

After the eight data and order files are created, the user must make system assignments that relate these files to predesignated file numbers in the operating procedure file. The operating procedure file is named PROCFIL when using the Boeing Cyber computer and PSEUPROC.OLD when using the VAX 11/780. Some additional data also must be input in order to initialize data arrays.

The number of situations and ammunition supply points may vary, and must be input by the user. Since the user has created the eight data files, the program must be initialized with the number of systems, techniques, tasks, single job orders, multiple job orders, standard requirements codes, engineer units, and tactical units created. The user then must assign these files the numbers 9, 11, 13, 15, 17, 19, 21, and 23. These numbers correspond to internal program file numbers (see Volume III). Thus, the (xxx) ESY file becomes the internal program file SIMUØ9, the file (xxx) TEC becomes the internal file SIMU11, etc. The file SIMU25 is reserved for interface data required between the Engineer Module and CORDIVEM (see Volume III).

Report flags (Ø or 1) are used to echo input as output, if so desired. A Ø means suppress output and a 1 means print input as output for each data file used. Since some of

the data files may be quite large, the user may wish to condense output by using the report flags to suppress the printout of files which were not changed between program runs.

The output level (10, 20, 30, 40 or 50) corresponds to the detailed level of information which the user wishes to see as simulation output. The higher the number, the greater the detail. The output level has the following values:

1. 10 = summary information
2. 20 = order information
3. 30 = job information
4. 40 = activity information
5. 50 = unit information

The final input to PROCFIL is the color (BLUE or RED) and X and Y coordinates of each ammunition supply point. Ammunition supply points are determined by the user from the scenario to be modeled.

IMPORTANT: Changes in the data base (i.e., number of situations, techniques, etc.) *require* the user to update PROCFIL before running a simulation program.

PROCFIL: Input Instructions

1. Number of Situations   Number of Ammunition Supply Points
2. Number of ESY   Number of TEC   Number of TSK   Number of SJO
Number of MJO   Number of SRC   Number of EUT   Number of TUT
3. File Numbers for (ESY TEC TSK SJO MJO SRC EUT TUT)
4. Report Flags for (ESY TEC TSK SJO MJO SRC EUT TUT)
5. Output Level (1Ø, 2Ø, 3Ø, 4Ø, or 5Ø)
6. Color of Ammunition Supply Point (BLUE or RED)
7. X Location   Y Location

NOTE: REPEAT 6 AND 7 FOR EACH AMMUNITION SUPPLY POINT.

PROCFIL: Sample Input Data

1 2	*(number of situations, number of ammunition supply points)*
13 56 17 1 19 3 4 2	*(number of* ESY, TEC, TSK, SJO, MJO, SRC, EUT, *and* TUT*)*
9 11 13 15 17 19 21 23 25	*(file numbers for* ESY, TEC, TSK, SJO, MJO, SRC, EUT, *and* TUT*)*
Ø Ø Ø Ø Ø 1 1 1 Ø	*(report flags for* ESY, TEC, TSK, SJO, MJO, SRC, EUT, *and* TUT*)**
5Ø	*(output level)*
BLUE	*(color of ammunition supply point)*
85 18Ø	*(X location, Y location)*
BLUE	*(color of ammunition supply point)*
136 1Ø3	*(X location, Y location)*

*The ninth report flag, interface, must be set at Ø.

Assignment File (DECVAX 11/780 Only)

A data file named ASSGN.OLD must be created for model operation on the VAX/VMS operating system. This file frees the user from having to input each file name before each run of the model. The user may give the first nine data files any desired name within the previously defined convention (⟨xxx⟩ ESY, ⟨xxx⟩ EUT, ⟨xxx⟩ TSK, etc.). Each of these file names, however, must be translated into names that the Engineer Module's internal operating system will recognize. The ASSGN.OLD file accomplishes this task.

In this example, CORDIV.PROCESS.ENGR is the name of the account where the data files reside and D86 is the three-character prefix (⟨xxx⟩) to the file names:

ASSGN.OLD: Sample Input Data

```
ASSIGN [CORDIV.PROCESS.ENGR] D86ESY.DAT SIMU09
ASSIGN [CORDIV.PROCESS.ENGR] D86TEC.DAT SIMU11
ASSIGN [CORDIV.PROCESS.ENGR] D86TSK.DAT SIMU13
ASSIGN [CORDIV.PROCESS.ENGR] D86SJO.DAT SIMU15
ASSIGN [CORDIV.PROCESS.ENGR] D86MJO.DAT SIMU17
ASSIGN [CORDIV.PROCESS.ENGR] D86SRC.DAT SIMU19
ASSIGN [CORDIV.PROCESS.ENGR] D86EUT.DAT SIMU21
ASSIGN [CORDIV.PROCESS.ENGR] D86TUT.DAT SIMU23
ASSIGN [CORDIV.PROCESS.ENGR] D86JOBS.DAT SIMU47
ASSIGN [CORDIV.PROCESS.ENGR] PSEUPROC.OLD SIMU31
ASSIGN OUT.USE                            SIMU33
ASSIGN OUT.HIS                            SIMU35
```

Operating Procedures (Boeing Cyber Computer Only)

After the user has created the eight basic data files, an order stream file, and *updated the procedure file*, a simulation program may be run. The eight major data files are considered as two types of data: standard operating procedures (SOP) and force structure (STRUCT). The SOP consists of the engineer system's techniques, tasks, single job orders, and multiple job orders. The STRUCT consists of the standard requirements codes, engineer units, and tactical units. This division was made since it was thought the SOP would not change very often, but the user might wish to change the force structure and make separate runs using the same order stream.

The engineer systems data file (⟨xxx⟩ ESY) *must* be assigned to SIMU09, the techniques data file (⟨xxx⟩ TEC) to SIMU11, and so on.

The assignment file also assigns the Engineer Module output which is created during each simulation run. Outputs are described in Chapter 3.

All files in the SOP group must have identical three-character prefixes (⟨xxx⟩). The three files in the STRUCT group must have identical prefixes. (See Table 3.)

The user is assumed to have some experience with automated data processing (ADP) systems. Instructions are given for model operation on the Boeing Computer system. To create and update the data base, see the *MAINSTREAM-EKS Interactive Timesharing (KIT) Users Manual.*

To log onto the Boeing system, the user must dial the local Boeing telephone number to activate a terminal session. The user must press the return key to (1) start a session,

Table 3
File Prefixes

SOP Group	STRUCT Group	Order Stream
1. CD1ESY	6. D86SRC	9. TSTJOBS
2. CD1TEC	7. D86EUT	
3. CD1TSK	8. D86TUT	
4. CD1SJO		
5. CD1MJO		

and (2) after each input line is typed. The Boeing system will return with system messages and the following prompts:

System Prompt	*User Response*
1. SELECT DESIRED SERVICE:	EKS1
2. USERNUMBER:	XXX
3. PASSWORD:	YYY
4. RECOVER/USER ID:	ZZZ

The user's response will depend on the local ADP assignment of a user number and password. The RECOVER/USER ID is an alphanumeric response by the user, such as his or her name.

The following paragraphs give examples of the five types of output commands.

1. How to submit a simulation program.

2. How to check on the progress of a simulation run if response time is slow.

3. How to get a computer listing of simulation output.

4. How to get an alphabetical listing of all data base input.

5. How to get an abbreviated listing of the data base input files.

To Submit a Job

BEGIN, SEND,, PRE = ⟨xxx⟩, STRUCT = ⟨xyz⟩,
WAIT = YES/NO, EDIT = YES/NO, REMOTE = YES/NO, SOP = ⟨zzz⟩

PRE = ⟨xxx⟩ is the prefix for the job stream and output (one to three characters). Order stream file must be called ⟨xxx⟩ JOBS.

If PRE = TST, order stream = TSTJOBS.

STRUCT = ⟨xyz⟩ is the prefix for command structure files.

WAIT = YES, if user wants interactive output (default).

WAIT = NO, if user does not want interactive output.

EDIT = YES, if user wants to edit output when the job is done (default).

EDIT = NO, if user does not want to edit output.

REMOTE = NO. Output becomes edit file (default).

REMOTE = YES. Output goes to remote job terminal.

SOP = ⟨zzz⟩ is the prefix for standard operating procedure. Files: ZZZESY, ZZZTEC, ZZZTSK, ZZZSJO, ZZZMJO.

To Check on a Job

BEGIN, CKJOB, PRE = ⟨xxx⟩, EDIT = YES/NO

PRE and EDIT are defined as explained above.

To Print Files

BEGIN, PRINT, ⟨filename⟩, PS = SHFT, NUM = ⟨n⟩

If PRE = TST, output ⟨filenames⟩ are TSTOUT and TSTHOUT.

PS = Print Shift

NUM = Number of copies (1 is default)

To Obtain an Alphabetized Data Base List of Input

PURGE, JEROUT

BEGIN, REPORT,, ⟨xxx⟩ ESY, ⟨xxx⟩ TEC, ⟨xxx⟩ TSK, ⟨xxx⟩ SJO,
⟨xxx⟩ MJO, ⟨xxx⟩ SRC, ⟨xxx⟩ EUT, ⟨xxx⟩ TUT

To Obtain an Alphabetical List of Techniques, Tasks, or Single Job Orders

GET, JEROUT

BEGIN, EXTRACT,, JEROUT

BEGIN, SORTLST,, NUM = n

⟨filename⟩

n = number of copies

Operating Procedures (DEC VAX 11/780 Only)

After the user has created the eight basic data files, an order stream file, an assignment file, and updated the procedure file, a simulation program may be run.

To log onto the VAX/VMS system, the user must press the return key to (1) start the session, and (2) after each input line is typed. The system will respond with the following prompts and system messages:

System Prompt	*User Response*
Username:	ABCDEF
Password:	LMNOPQ

The user response will depend on the local ADP assignment of a user name and password. To create or change the data base files, the user should consult the "VAX-11 EDT Editor Reference Manual," in the *VAX/VMS Users Manual, Volume 3A.*

When the user has correctly logged in, the system will respond with an $ prompt. To run the model, the user must give the following inputs in response to the prompts:

System Prompt	*User Response*
$	@[xxx.xxxx] assgn.old
$	simrun [zzz] salone2

Square brackets enclose the names of the accounts where the named files reside. In this example, the ASSIGN.OLD file resides in account xxx.xxxx and the executable Engineer Module (SALONE2.EXE) resides in account zzz.

3 OUTPUT

The Engineer Module program output has two parts: a file named ⟨xxx⟩ OUT on the Boeing Cyber or OUT.USE on the VAX 11/780, and a file named ⟨xxx⟩ HOUT on the Cyber or OUT.HIS on the VAX. The ⟨xxx⟩ is the same prefix as the ⟨xxx⟩ JOBS file prefix that contained the order stream (see **Operating Procedures,** Chapter 2).

The ⟨xxx⟩ OUT file contains:

1. Ammunition supply points (their location)

2. Standard requirements code

3. Engineer units (their location and support relationships)

4. Tactical units (their support relationships)

5. Simulation run time (hours)

6. Total jobs generated, number completed, number infeasible

7. Total orders generated, number completed, number infeasible

8. Statistics for engineering units (hours)

   a. Not assigned

   b. Queued

c. Assigned

d. Wait at work site

e. Wait halted

f. Site work

g. Ammunition supply point upload

h. Move to work site

i. Model move from work site back to parent location.

An example of ⟨xxx⟩ OUT file is shown in Figure 4.

The ⟨xxx⟩ HOUT file is a timeline trace which starts at time 0 and ends with the end of the simulation run. The output level is set as noted in PROCFIL and has the following values:

1. **10** = summary information
2. **20** = order information
3. **30** = job information
4. **40** = activity information
5. **50** = unit information.

Output level **50** gives a detailed trace of each unit (Figure 5). The fields have the following values:

1. Five-character order abbreviation
2. The order number and a two-character order abbreviation
3. A sequence number for post-processing
4. Clock time
5. Order number pointer (six digits)
6. Job number pointer (six digits)
7. Unit number
8. Activity description.

```
1          1    AMMUNITION SUPPLY POINTS (ASPS)

         COLOR       X.LOCATION     Y.LOCATION
          BLUE          31.00          31.00
1           3 SRC TABLES

         FOR BLUE SRC     1    WITH TITLE ENG.PLT.DIV

         ENGR SYSTEM QUANTITY               TITLE

                        3.0            SQUAD
                        1.0            CEV
                        2.0            ACE

         FOR BLUE SRC     2    WITH TITLE ENG.CO.DIV.POOL

         ENGR SYSTEM QUANTITY               TITLE

                        1.0            GEMSS
                        1.0            2.5 LOADER
                        6.0            AVLB
                        2.0            SLUFAE

         FOR BLUE SRC     3    WITH TITLE NONE

         ENGR SYSTEM QUANTITY               TITLE

                        0.0
1           5   ENGR UNIT TABLES

         FOR BLUE ENGR UNIT      1     WITH TITLE 1ST.PLT.A.CO
         USING SRC NUMBER    1 WITH TITLE ENG.PLT.DIV

         ENGR UNIT ---   PARENT   SUPPORTED TAC UNIT     X.LOC         Y.LOC
                           5                1             32.0          33.0


         FOR BLUE ENGR UNIT      2     WITH TITLE 2ND.PLT.A.CO
         USING SRC NUMBER    1 WITH TITLE ENG.PLT.DIV

         ENGR UNIT ---   PARENT   SUPPORTED TAC UNIT     X.LOC         Y.LOC
                           5                2             33.0          34.0


         FOR BLUE ENGR UNIT      3     WITH TITLE 3RD.PLT.A.CO
         USING SRC NUMBER    1 WITH TITLE ENG.PLT.DIV

         ENGR UNIT ---   PARENT   SUPPORTED TAC UNIT     X.LOC         Y.LOC
                           5                3             33.0          31.0


         FOR BLUE ENGR UNIT      4     WITH TITLE A.CO.POOL
         USING SRC NUMBER    2 WITH TITLE ENG.CO.DIV.POOL

         ENGR UNIT ---   PARENT   SUPPORTED TAC UNIT     X.LOC         Y.LOC
                           5                0             33.0          31.0


         FOR BLUE ENGR UNIT      5     WITH TITLE A.CO.HQ
         USING SRC NUMBER    3 WITH TITLE NONE
```

Figure 4. Example (xxx) OUT file.

```
ENGR UNIT ---  PARENT  SUPPORTED TAC UNIT   X.LOC       Y.LOC
                NONE              0           26.0       31.0

   NUMBER OF UNITS TO BE CREATED    28
1          4   TACTICAL UNIT TABLES

       FOR BLUE TACTICAL UNIT    1   WITH TITLE 5TH.BN.1ST.BDE

       PARENT   SUPPORT ENGR UNIT
       NONE          1

       FOR BLUE TACTICAL UNIT    2   WITH TITLE 6TH.BN.1ST.BDE

       PARENT   SUPPORT ENGR UNIT
       NONE          2

       FOR BLUE TACTICAL UNIT    3   WITH TITLE 7TH.BN.1ST.BDE

       PARENT   SUPPORT ENGR UNIT
       NONE          3

       FOR BLUE TACTICAL UNIT    4   WITH TITLE 8TH.BN.1ST.BDE

       PARENT   SUPPORT ENGR UNIT
       NONE          4
1
   SIMULATION STOPPED AT   20.34 HOURS

TOTAL NUMBER OF JOBS          9       NUMBER COMPLETED          9 NUMBER INFEASIBLE         0
TOTAL NUMBER OF ORDERS          1     NUMBER COMPLETED          1 NUMBER INFEASIBLE         0

 STATISTICS FOR ENGINEERING UNITS IN HOURS
```

UNIT	ENGR SYSTEM	NOT ASSIGNED	QUEUED	ASSIGNED	WAIT AT A.S.	WAIT HALTED	SITE WORK	ASP UPLOAD	MOVE	MODEL MOVE
1	SQUAD	7.51	0.	0.	.05	0.	12.70	0.	.04	.04
2	SQUAD	7.51	0.	0.	.05	0.	12.70	0.	.04	.04
3	SQUAD	7.51	0.	0.	.05	0.	12.70	0.	.04	.04
4	CEV	5.04	0.	0.	10.03	0.	5.00	0.	.13	.13
5	ACE	0.	0.	0.	5.17	0.	15.00	0.	.09	.09
6	ACE	0.	0.	0.	5.17	0.	15.00	0.	.09	.09
7	SQUAD	20.34	0.	0.	0.	0.	0.	0.	0.	0.
8	SQUAD	20.34	0.	0.	0.	0.	0.	0.	0.	0.
9	SQUAD	20.34	0.	0.	0.	0.	0.	0.	0.	0.
10	CEV	20.34	0.	0.	0.	0.	0.	0.	0.	0.
11	ACE	20.34	0.	0.	0.	0.	0.	0.	0.	0.
12	ACE	20.34	0.	0.	0.	0.	0.	0.	0.	0.
13	SQUAD	20.34	0.	0.	0.	0.	0.	0.	0.	0.
14	SQUAD	20.34	0.	0.	0.	0.	0.	0.	0.	0.
15	SQUAD	20.34	0.	0.	0.	0.	0.	0.	0.	0.
16	CEV	20.34	0.	0.	0.	0.	0.	0.	0.	0.
17	ACE	20.34	0.	0.	0.	0.	0.	0.	0.	0.
18	ACE	20.34	0.	0.	0.	0.	0.	0.	0.	0.
19	GEMSS	19.48	0.	0.	0.	0.	.77	0.	.05	.05
20	2.5 LOA	8.45	0.	0.	1.65	0.	10.00	0.	.12	.12
21	AVLB	20.34	0.	0.	0.	0.	0.	0.	0.	0.
22	AVLB	20.34	0.	0.	0.	0.	0.	0.	0.	0.
23	AVLB	20.34	0.	0.	0.	0.	0.	0.	0.	0.
24	AVLB	20.34	0.	0.	0.	0.	0.	0.	0.	0.
25	AVLB	20.34	0.	0.	0.	0.	0.	0.	0.	0.
26	AVLB	20.34	0.	0.	0.	0.	0.	0.	0.	0.
27	SLUFAE	20.34	0.	0.	0.	0.	0.	0.	0.	0.
28	SLUFAE	20.34	0.	0.	0.	0.	0.	0.	0.	0.

```
  EXIT      0
```

Figure 4. (Cont'd).

```
1
BPTY1        11   0.   166599         MULTIPLE JOB ORDER TITLED BATTLE POSITION TYPE 1
BPTY1        12   0.   166599           RECEIVED AT    0.    HOURS FOR  (ICOR REF          0 ) FOR GRID (  34.00,   33.00)
BPTY1        13   0.   166599           FOR TACTICAL UNIT 5TH.BN.1ST.BDE          ENGR UNIT 1ST.PLT.A.CO
BPTY1        14   0.   166599           WITH SITUATION  1 PRIORITY CLASS  0 LATE FINISH TIME   24.000 HOURS
BPTY1    4   41   0.   166599140049   TECH TEAM QUEUED AT TIME    0.    HOURS
BPTY1    4   42   0.   166599140049   ... FOR TECHNIQUE  36 WITH NAME INSTALL 500M. MINEFIELD - PLATOON+GEMSS
BPTY1    4   42   0.   166599140049   ... FOR TECHNIQUE  38 WITH NAME INSTALL 500M. MINEFIELD - PLATOON
BPTY1    5   41   0.   166599140009   TECH TEAM QUEUED AT TIME    0.    HOURS
BPTY1    5   42   0.   166599140009   ... FOR TECHNIQUE  12 WITH NAME CONSTRUCT 500M. ATD - ACE + ACE
BPTY1    5   42   0.   166599140009   ... FOR TECHNIQUE  14 WITH NAME CONSTRUCT 500M. ATD - ACE + 2.5 LOADER
BPTY1    5   42   0.   166599140009   ... FOR TECHNIQUE  13 WITH NAME CONSTRUCT 500M. ATD - ACE + CEV
BPTY1    5   42   0.   166599140009   ... FOR TECHNIQUE   7 WITH NAME CONSTRUCT 500M. ATD - CEV + CEV
BPTY1    5   42   0.   166599140009   ... FOR TECHNIQUE   9 WITH NAME CONSTRUCT 500M. ATD - CEV + 2.5 LOADER
BPTY1    6   41   0.   166599139969   TECH TEAM QUEUED AT TIME    0.    HOURS
BPTY1    6   42   0.   166599139969   ... FOR TECHNIQUE   5 WITH NAME CONSTRUCT 10 DEFILADES - 2ACE + CEV
BPTY1    6   42   0.   166599139969   ... FOR TECHNIQUE   6 WITH NAME CONSTRUCT 10 DEFILADES-CEV
BPTY1    7   41   0.   166599139929   TECH TEAM QUEUED AT TIME    0.    HOURS
BPTY1    7   42   0.   166599139929   ... FOR TECHNIQUE  36 WITH NAME INSTALL 500M. MINEFIELD - PLATOON+GEMSS
BPTY1    7   42   0.   166599139329   ... FOR TECHNIQUE  38 WITH NAME INSTALL 500M. MINEFIELD - PLATOON
BPTY1    8   41   0.   166599139889   TECH TEAM QUEUED AT TIME    0.    HOURS
BPTY1    8   42   0.   166599139889   ... FOR TECHNIQUE  12 WITH NAME CONSTRUCT 500M. ATD - ACE + ACE
BPTY1    8   42   0.   166599139889   ... FOR TECHNIQUE  14 WITH NAME CONSTRUCT 500M. ATD - ACE + 2.5 LOADER
BPTY1    8   42   0.   166599139889   ... FOR TECHNIQUE  13 WITH NAME CONSTRUCT 500M. ATD - ACE + CEV
BPTY1    8   42   0.   166599139889   ... FOR TECHNIQUE   7 WITH NAME CONSTRUCT 500M. ATD - CEV + CEV
BPTY1    8   42   0.   166599139889   ... FOR TECHNIQUE   9 WITH NAME CONSTRUCT 500M. ATD - CEV + 2.5 LOADER
BPTY1    9   41   0.   166599139849   TECH TEAM QUEUED AT TIME    0.    HOURS
BPTY1    9   42   0.   166599139849   ... FOR TECHNIQUE   5 WITH NAME CONSTRUCT 10 DEFILADES - 2ACE + CEV
BPTY1    9   42   0.   166599139849   ... FOR TECHNIQUE   6 WITH NAME CONSTRUCT 10 DEFILADES-CEV
BPTY1  1CE   11   0.   166599156366   JOB STARTED FOR ORDER (ICOR REF          0 ) AT GRID (  34.00,   33.00) JOB UNITS ARE
BPTY1  1CE   12   0.   166599156366            1   SQUAD
BPTY1  1CE   12   0.   166599156366            2   SQUAD
BPTY1  1CE   12   0.   166599156366            3   SQUAD
BPTY1  1CE   13   0.   166599156366   FOR SINGLE JOB ORDER CONSTRUCT 500 METER MINEFIELD
BPTY1  1CE   14   0.   166599156366   AT TIME    0.    EST FINISH TIME   11.973 LATE FINISH TIME    24.000 -- HOURS
BPTY1  1CE   15   0.   166599156366   WITH PRIORITY   5 FOR ENGR UNIT 1ST.PLT.A.CO
BPTY1  1CE   16   0.   166599156366   FOR TECHNIQUE INSTALL 500M. MINEFIELD - PLATOON
BPTY1  1CE   11   0.   166599156366 1 START  MOVE, UNIT     1 STATUS  1 AT     0.    HOURS
BPTY1  1CE   12   0.   166599156366 1   FROM GRID(       32.00,       33.00) TO GRID(       34.00,       33.00) FOR JOB
BPTY1  1CE  111   0.   166599156366   ACTIVITY STARTED,  TYPE M.WS  AT     0.    HOURS
BPTY1  1CE   11   0.   166599156366 2 START  MOVE, UNIT     2 STATUS  1 AT     0.    HOURS
BPTY1  1CE   12   0.   166599156366 2   FROM GRID(       32.00,       33.00) TO GRID(       34.00,       33.00) FOR JOB
BPTY1  1CE  211   0.   166599156366   ACTIVITY STARTED,  TYPE M.WS  AT     0.    HOURS
BPTY1  1CE   11   0.   166599156366 3 START  MOVE, UNIT     3 STATUS  1 AT     0.    HOURS
BPTY1  1CE   12   0.   166599156366 3   FROM GRID(       32.00,       33.00) TO GRID(       34.00,       33.00) FOR JOB
BPTY1  1CE  311   0.   166599156366   ACTIVITY STARTED,  TYPE M.WS  AT     0.    HOURS
BPTY1  2CH   11   0.   166599156326   JOB STARTED FOR ORDER (ICOR REF          0 ) AT GRID (  34.00,   33.00) JOB UNITS ARE
BPTY1  2CH   12   0.   166599156326            5   ACE
BPTY1  2CH   12   0.   166599156326            6   ACE
BPTY1  2CH   13   0.   166599156326   FOR SINGLE JOB ORDER CONSTRUCT 500M. ANTITANK DITCH
BPTY1  2CH   14   0.   166599156326   AT TIME    0.    EST FINISH TIME    5.644 LATE FINISH TIME    24.000 -- HOURS
BPTY1  2CH   15   0.   166599156326   WITH PRIORITY   5 FOR ENGR UNIT 1ST.PLT.A.CO
BPTY1  2CH   16   0.   166599156326   FOR TECHNIQUE CONSTRUCT 500M. ATD - ACE + ACE
BPTY1  2CH   11   0.   166599156326 5 START  MOVE, UNIT     5 STATUS  1 AT     0.    HOURS
BPTY1  2CH   12   0.   166599156326 5   FROM GRID(       32.00,       33.00) TO GRID(       34.00,       33.00) FOR JOB
1BPTY1 2CH  111   0.   166599156326   ACTIVITY STARTED,  TYPE M.WS  AT     0.    HOURS
BPTY1  2CH   11   0.   166599156326 6 START  MOVE, UNIT     6 STATUS  1 AT     0.    HOURS
BPTY1  2CH   12   0.   166599156326 6   FROM GRID(       32.00,       33.00) TO GRID(       34.00,       33.00) FOR JOB
BPTY1  2CH  211   0.   166599156326   ACTIVITY STARTED,  TYPE M.WS  AT     0.    HOURS
BPTY1  3SA   11   0.   166599156286   JOB STARTED FOR ORDER (ICOR REF          0 ) AT GRID (  34.00,   33.00) JOB UNITS ARE
```

Figure 5. Example (xxx) HOUT file.

APPENDIX A:
BIBLIOGRAPHY

General

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APPENDIX B: SIMULATION CONTROL ERRORS

The following errors are caused by user error and are ultimately fatal.

1. *****WARNING***** NUMBER OF ENGR SYSTEMS READ = _____,
   NUMBER EXPECTED WAS _____.

2. *****WARNING***** NUMBER OF TECH READ = _____,
   NUMBER EXPECTED WAS _____.

3. *****WARNING***** NUMBER OF TASKS READ = _____,
   NUMBER EXPECTED WAS _____.

4. *****WARNING***** NUMBER OF SJOS READ = _____,
   NUMBER EXPECTED WAS _____.

5. *****WARNING***** NUMBER OF MJOS READ = _____,
   NUMBER EXPECTED WAS _____.

6. *****WARNING***** NUMBER OF SRCS READ = _____,
   NUMBER EXPECTED WAS _____.

7. *****WARNING***** NUMBER OF ENGR UNITS READ = _____,
   NUMBER EXPECTED WAS _____.

8. *****WARNING***** NUMBER OF TACTICAL UNITS READ = _____,
   NUMBER EXPECTED WAS _____.

These errors indicate the user has fewer or more systems (techniques, tasks, single job orders, multiple job orders, standard requirements codes, engineer units, or tactical units) than those specified in PROCFIL. The user should edit PROCFIL to correct the number of engineer systems, techniques, tasks, single job orders, multiple job orders, standard requirements codes, engineer units, and/or tactical units (#TEC, #TSK, #SJO, #MJO, #SRC, #EUT, #TUT) and rerun.

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